onds/100 microseconds=330 points, with 200 points or less taking into consideration overhead for communication etc. being an appropriate value.

[0070] A function for changing the stimulation determination function in real time is referred to as an automatic threshold value adjustment function. The following two effects are achieved by implementing the threshold value automatic adjustment function. First, a stimulation frequency of at least 30 Hz is ensured by suppressing the total number of stimuli. The first problem, "unpleasantness due to stimulation of less then 30 Hz" is therefore reduced as a result. Next, an intermediate gradation representation is implemented by increasing the number of stimuli at one point rather than just having the 0/1 representation of the related art.

[0071] In a typical implementation, first, the scanning frequency for the stimulation points in their entirety is fixed at 30 Hz (one cycle: 33 milliseconds). Stimulation intensity can be changed between 30 Hz to 210 Hz by stimulating each stimulation point between zero to seven times during this cycle. At this time, a function for performing adjustment using a threshold value automatic adjustment function is extended and adjustment takes place so that the total stimulation (number of times, not number of points) does not exceed the maximum stimulation number.

[0072] In this case, the expression of eight gradations of 0 to 7 is taken but further intermediate representations are also possible. This is implemented by the following algorithm.

[0073] Suppose that gradation to output at a certain cycle t is taken to be Xt (a non-integral value between 0.0 and 7.0). Xt is divided into an integer part iXt and a fractional part dXt. Stimulation takes place in this cycle iXt times and the fraction part dXt is preserved. Suppose that at the next cycle, gradation to output is Xt+1, this is added to the remainder for the previous time. After this, this is similarly divided into an integer part and a fractional part with the number of times for the integer part being stimulated and the fractional part being saved. As a result of this repeating, it is possible to output intermediate gradation in a time-averaged manner. Presentation of a two-dimensional pattern is possible using grayscale with the above algorithm rather than using the two values of black and white.

[0074] A description is given in the following of a threshold value automatic adjustment function. A relationship between the threshold value automatic adjustment function and other image processing functions is shown in FIG. **15**. First, image data from the camera **1** is converted to processed images by the image processing unit **2**B. The image processing is exemplified by edge extraction, contour extraction, "corner" extraction, color extraction, motion detection, and pattern recognition, etc. Electrical stimulation is carried out from the electrode matrix **3**A based on the converted data. Threshold value control is then carried out at the threshold value automatic adjustment section **2**C when electrical stimulation is carried out.

[0075] A description is now given of threshold value control at the threshold value automatic adjustment section **2**C. In the following, suppose that representation is implemented using only the two values of stimulation performed/not performed. A "stimulation determination function" is necessary to determine whether or not stimulation is carried out. For example, this is as follows.

[0076] "Stimulate when certain data is of a size of a threshold value or more. Do not stimulate when this is not the case"

$$N(i) = \begin{cases} 1 & (d(i) \geq \text{threshold}) \\ 0 & \text{otherwise} \end{cases} \quad \text{[Equation 1]}$$

[0077] Where, N(i) indicates the number of stimulations at the Ith point, d(i) is data, and "threshold" denotes the threshold value.

[0078] At this time, stimulation is carried out by scanning one point at a time. This means that if the "total number of stimulations" defined in the following equation is exceeded, the frequency of the stimulation lowers.

$$\sum_{i=1}^{M} N(i) \quad \text{[Equation 2]}$$

[0079] Where N(i) is the number of stimuli of the Ith electrode occurring in one cycle, and M is the total number of electrodes. Here, N(i) can only take the value 0 or 1. This means that the total number of stimuli is the same as the number of stimuli. This means that it is necessary to change the threshold value within the "stimulation determination function" in order to suppress the number of stimulation points. In the system shown in FIG. **15**, the camera refresh rate is fixed. A new image is therefore inputted in a fixed time interval. For example, an image is updated every 33 milliseconds for a 30 fps camera. The electrical stimulation therefore has to finish scanning within 33 milliseconds. This means that stimulation can only take place 330 times when, for example, the time for one stimulation is 100 microseconds. This is the "maximum number of stimuli" permitted. In reality, the value is smaller because of overhead for communication etc.

[0080] For example, the following algorithm can be considered for adjustment of the threshold value of the stimulation determination function. First, an initial value for the threshold value is set by a user's input. When the number of times of stimulation for the stimulation determination function using this initial value does not exceed the maximum number of times of stimulation, the threshold value is not changed. However, when the number of times of stimulation exceeds the maximum number of times of stimulation, the threshold value is increased until the number of times of stimulation is less than the maximum number of times of stimulation. It is possible to obtain a minimum threshold value for ensuring that the number of times of stimulation is less than the maximum number of times of stimulation using the well-known binary tree method, etc.

[0081] When a large number of stimulations is permitted for one point and grey scale representation is implemented rather than black and white representation, the system configuration from the camera up to the stimulation electrodes is not changed and the camera refresh rate is also not changed. For example, the image is updated every 33 milliseconds. The intensity of stimulation at a certain stimulation point is defined as the number of times this point can be stimulated during a 33-millisecond cycle. The stimulation determination function is a function of original data having one or more